|  |  |  |  |
| --- | --- | --- | --- |
| **Module:** | *5061* | **Module**  **Code:** | *Insert code* |
| **Level:** | *5* | **Module Credit Value:** | *20/40* |
| **Module**  **Coordinator(s):** | *Nicky Gregory* | | |
| **Date:** | *Insert start date* | **Deadline:** | *Hand in deadline* |

**Assessment Title: *Network design and testing (1 of 1)***

**Rationale:**

* To enable students to reflect on issues concerning the planning, design and administration of LAN networks, and to make informed judgements on these issues.

# To prepare students to careers in LAN Systems Development and Networking Services

**Aims:**

* Demonstrate competence in use of NOS utilities as aids to LAN network administration and management.
* Demonstrate competence in use of a network diagramming tool as an aid to LAN network design, documentation and management.
* Demonstrate competence in use of advanced addressing techniques in simulated network scenarios.

**Learning Outcomes:**

* 6.3 LAN Industry Frameworks and Standards
* 6.5 LAN Network Management case studies

**Assessment Method(s):**

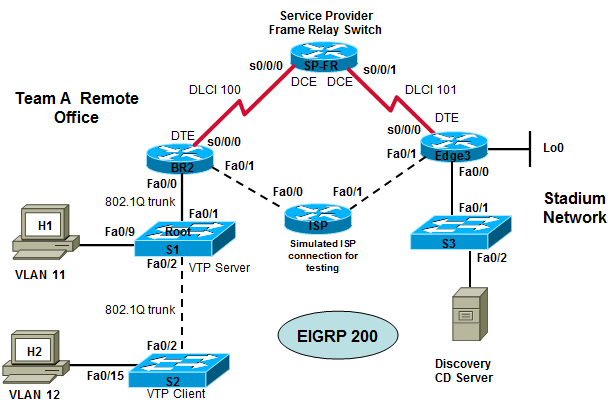
**Module components: Weighting Assessment Type:**

Team-A office (LO 6.3, 6.5) 50%*report*

Scenario

The new equipment has arrived for the remote Team-A office, and it is ready to be installed and tested.

Team-A ordered an 1841 router to connect to the main Stadium Headquarters Edge3 router through a Frame Relay service provider network. They also ordered a backup DSL link through the ISP. The ISP router and simulated Frame Relay router are preconfigured. The ISP link has assigned IP addresses. A test plan for testing the new equipment and configurations in the NetworkingCompany lab has already been created.



**Task 1:** Network Planning

* 6.3 LAN Industry Frameworks and Standards
* 6.5 LAN Network Management case studies

Objectives

Using the given network design create an IP addressing plan and document the network device interfaces. Create an installation checklist based on a test plan.

Network Planning

Analyze the remote network test plan and develop an IP addressing scheme.

Appendix A contains the Team–A test plan. Review the network design topology diagram and the tests to be performed. The general test procedures and the expected results are provided. Use the information that you acquire in the next steps, along with the topology diagram and equipment list in the test plan, to create a VLSM subnet plan and an IP addressing plan.

1. Document the assigned network IP addressing.
2. You will be working with the Team-*A* remote network,
3. The base IP address CIDR block of 512 addresses from which you will create your VLSM addressing scheme is based on a private Class B network address.
4. IP address: **172.21.0.0**
5. Allocate blocks of addresses to each area of the network.

VLSM and VLAN Plan

| **Network Area** | **Number of Users / IPs** | **VLSM block size (Number of IPs)** | **IP Address Range** |
| --- | --- | --- | --- |
| **Team-*1* block size to subdivide** | N/A | 512 (9 bits) | 172.21.0.0/23 |
| **Edge3 Discovery Server local network** | N/A | N/A | 172.17.0.0/16 |
| **Edge3 user local network (Sim Lo0)** | 195 | 256 (8 bits) 8 bits needed because 7 bits would only allow 128 addresses and 9 bits allows too many | 172.21.1.0/24  This network address allows 256 addresses and 254 hosts. |
| **BR2 local network / VLANs** |  |  |  |
| VLAN 1 (Default/mgmt – IP) | 12 | 16 (4 bits)  4 bits needed because 3 bits would only allow 8 addresses and 5 bits allows too many | 172.21.1.192/28  This network address allows for 16 addresses and 14 hosts. |
| VLAN 11 (Name: Dept-11, Ports 3-11 on switches S1, S2) | 53 | 64 (6 bits)  6 bits needed because 5 bits would only allow 32 addresses and 7 bits allows too many | 172.21.1.128/26  This network address allows for 64 addresses and 62 hosts |
| VLAN 12 (Name: Dept-12, Ports 12-24 on switches S1, S2) | 105 | 128 (7 bits)  7 bits needed because 6 bits would only allow 64 addresses and 8 bits allows too many. | 172.21.1.0/25  This network address allows 128 addresses and 126 hosts. |
| **BR2 to Edge3 Frame Relay WAN link** | 2 | 4 (3 bits)  3 bits needed because 2 bits would only allow 4 addresses and 4 bits allows too many | 172.21.1.208/30  This network address allows for 4 addresses an 2 hosts. |
| **Total users and total block sizes** | 367 |  | N/A |

1. Select IP addresses for use when configuring devices.

Write the addresses and subnet masks (/##) from the IP Address Plan next to the appropriate devices and interfaces on the test plan network topology diagram.

**IP Address Plan**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Device Name** | **Interface** | **IP Address** | **Subnet Mask** | **Default Gateway** |
| Edge3 | Fa0/0  Fa0/1  S0/0/0.101  Lo0 | 172.17.0.1/16  172.16.1.6/30  172.21.1.209/30  172.21.0.62/24 | 255.255.0.0  255.255.255.252  255.255.255.252  255.255.255.0 | N/A |
| BR2 | Fa0/1  Fa0/0  Fa0/0.1  Fa0/0.11  Fa0/0.12  S0/0/0.100 | 172.16.1.2/30  172.21.1.195/28  172.21.1.130/26  172.21.1.6/25  172.21.1.213 (DLCI 100) | 255.255.255.252  255.255.255.240  255.255.255.192  255.255.255.128  N/A | N/A |
| ISP (preconfigured) | Fa0/0  Fa0/1 | 172.16.1.1/30  172.16.1.5/30 | 255.255.255.252  255.255.255.252 | N/A |
| SP-FR (preconfigured) | S0/0/0  S0/0/1 | 172.21.1.214 (DLCI 100)  DLCI 101 | N/A  N/A | N/A |
| S1 | VLAN1 | 172.21.1.193/28 | 255.255.255.240 | 172.21.1.195/24 |
| S2 | VLAN1 | 172.21.1.194/28 | 255.255.255.240 | 172.21.1.195/24 |
| S3 (optional) | VLAN1 | 172.17.0.2/16 | 255.255.0.0 | 172.17.0.1/16 |
| H1 | NIC | 172.21.1.131/26 | 255.255.255.192 | 172.21.1.130/24 |
| H2 | NIC | 172.21.1.2/24 | 255.255.255.0 | 172.21.1.6/24 |
| Discovery Server | NIC | 172.17.1.1/16 | 255.255.0.0 | 172.17.0.1/16 |

1. Create a network installation checklist.

Review each test and the related test procedures in the Team-A test plan in Appendix A to create an installation checklist. Use the following guidelines to build the checklist:

* Identify the steps necessary to configure each piece of equipment to perform each test. List only the configuration steps needed to complete the test. Be sure to specify the device name and what is to be configured.
* Specify just the key items and interfaces to be configured. It is not necessary to include the exact commands and every IP address.
* For each step under the configuration requirements, first identify the device being configured and then the item to be configured. Use as many lines as necessary.
* The final step in each set of installation test requirements specifies to perform the test as described in the test plan.

Team-A Prototype Network Installation Checklist

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Installation Steps** |  |
| **Step No.** | **Devices** | **Test 1: Basic Connectivity and VLAN Configuration**  **Configuration Requirements** | **Completed** |
| 1 | H1,H2 | IP and subnet config, gateway, cables connected. |  |
| 2 | S1 | Trunk ports setup fa0/1 and fa0/2, Root switch config, Vlan 11 on ports fa0/3 – 11 VLAN 12 on ports fa0/12 -24.  Switch#vlan database Switch(vlan) # vtp transparent Switch(vlan) #exit Switch#conf t Switch(config)#vlan 11 Switch(config-vlan)#name department11 Switch(config-vlan)#vlan 12 Switch(config-vlan)name department12 Switch(config-vlan)#end Switch#copy run start. |  |
| 3 | S2 | Trunk ports setup fa0/1 and fa0/2, Root switch config, Vlan 11 on ports fa0/3 – 11 VLAN 12 on ports fa0/12 -24.  Switch#vlan database Switch(vlan) # vtp transparent Switch(vlan) #exit Switch#conf t Switch(config)#vlan 11 Switch(config-vlan)#name department11 Switch(config-vlan)#vlan 12 Switch(config-vlan)name department12 Switch(config-vlan)#end Switch#copy run start.  \ |  |
| 4 |  |  |  |
| 5 | BR2 | Fa0/0 sub interfaces config, IP addresses, for VLANs, Router name,Frame Relay configuration, EIGRP configuration. |  |
| 6 | Edge 3 | Loopback IP address, fa0/0 0/1 IP addresses. |  |
| 7 | Server | IP address, subnet mask, gateway. |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |
| 12 |  |  |  |
|  |  |  |  |
|  |  |  |  |
| **Step No.** | **Devices** | **Test 2: Frame Relay and EIGRP Configuration**  **Configuration Requirements** |  |
| 1 | H1 H2 | Pint other host computer on another VLAN |  |
| 2 | H1 | Ping gateway |  |
| 3 | H2 | Ping gateway |  |
| 4 | BR2 | Ping H1 |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
|  |  |  |  |
|  |  |  |  |

***Insert task outcome:*** *[60%]*

**Task 2: Connect and configure the network equipment and verify network connectivity**.

* 6.3 LAN Industry Frameworks and Standards
* 6.5 LAN Network Management case studies

1. **Build the Network and Connect the Cables**

Using the equipment list and topology diagram provided in the test plan, and the installation checklist and IP address plan completed in Part 1, build and configure the network.

**Note:** The ISP router, the Frame Relay router, and the Discovery Server should be preconfigured by the instructor.

Use the following guidelines to build the test the network:

* Make sure that the router and switch startup configs and the switch vlan.dat files have been erased prior to beginning configuration.
* Be sure to save the running-config frequently and after any major configuration.
* After each test segment is built, have the instructor check off the test plan items to be verified.
* You can connect and configure all devices according to the installation checklist up.

1. Configure and Perform Test 1 – Basic Connectivity and VLAN Configuration
   1. Build and configure the portion of the network being tested.

Refer to the installation checklist for the steps required.

* 1. Review the expected test results.

Before beginning the test, review the expected results in the test plan. The testing procedures are listed here for convenience. Enter the command used.

# **Test 1 Testing Procedures**

|  |  |  |
| --- | --- | --- |
| **Configuration Items to Verify** | **Command Used** | **Check** |
| BR2 basic config (host, password, IPs) |  |  |
| BR2 interface status |  |  |
| BR2 routing table (VLANs) |  |  |
| BR2 subinterfaces on Fa0/0 |  |  |
| BR2 subinterfaces 802.1Q encap |  |  |
|  |  |  |
| S1 VLANs and port assignments |  |  |
| S1 802.1Q trunk ports |  |  |
| S1 is root switch |  |  |
| S1 is VTP server |  |  |
|  |  |  |
| S2 basic config (host, password, IPs) |  |  |
| S2 VLANs and port assignments |  |  |
| S2 802.1Q trunk ports |  |  |
| S2 is VTP client |  |  |
|  |  |  |
| Ping from S1 or S2 to BR2 |  |  |
| Telnet from S1 or S2 to router BR2 |  |  |
| Ping from the hosts to their default gateways |  |  |
| Verify inter-VLAN routing by pinging from H1 to H2 |  |  |

* 1. Record the results and conclusions.

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1. Task 3: Configure and Perform Test 2 – Frame Relay and EIGRP Configuration
   1. : Build and configure the portion of the network being tested.

Refer to the installation checklist for the steps required.

* 1. : Review the expected test results.

Before beginning the test, review the expected results in the test plan. The testing procedures are listed here for convenience. Enter the command used.

# **Test 2 Testing Procedures**

|  |  |  |
| --- | --- | --- |
| **Configuration Items to Verify** | **Command Used** | **Check** |
| BR2 configuration for Frame Relay, EIGRP, and MD5 authentication |  |  |
| BR2 Frame Relay status of point-to-point links |  |  |
| BR2 Frame Relay permanent virtual circuit (PVC) status and statistics |  |  |
| BR2 Frame Relay Local Management Interface (LMI) statistics |  |  |
| BR2 EIGRP routing configuration |  |  |
| BR2 routing table (EIGRP routes) |  |  |
|  |  |  |
| Ping from hosts H1 and H2 to the Edge3 router |  |  |
| Ping from hosts H1 and H2 to the Discovery Server |  |  |
| Verify path that packets are taking from H1 to the Discovery Server |  |  |
| Verify EIGRP MD5 authentication as it occurs |  |  |

* 1. : Record the results and conclusions.

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***Insert task outcome:*** *[40%]*

**Key References:**

**JOURNALS:**

Journals & publications

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      Burgess, M. (2000) "Principles of Nework and Systems Administration" John Wiley

      Goldman, J. & Rawles, P. (2001) "Applied Data Communications" Wiley

Haugdahl, J.S. (1999) "Practical Network Design, Management and Troubleshooting" Addison Wesley

      Johnson, A. (2006) “Switching Basics and Intermediate Routing CCNA 3 Labs and Study Guide” Pearson Education

      Mahmoud, Q. (2002) "Wireless Java" O'Reilly UK

**ELECTRONIC SOURCES:**

[**http://www.cisco.com/web/learning/netacad/index.html**](http://www.cisco.com/web/learning/netacad/index.html)

      www.cisco.com/warp/public/779/smbiz/netguide/  -  cisco networking essentials/

      www.microsoft.com/technet/treeview/default.asp?url=/technet/itsolutions/howto/

www.informationweek.com  -  industry news, technology reviews

Appendix A ­– Test Plan

**Team-A Remote Office Design**

The purpose of this test is to verify these items:

* Team-A branch network design
* Switch and router configurations proposed for the Team-A connections to the Stadium Network
* Frame Relay WAN design and backup capability
* Design functions as expected

Tests to run:

* **Test 1: Basic Connectivity and VLAN Configuration** 
  + Verify physical and IP connectivity between devices on the prototype network
  + Demonstrate the VLAN and VTP configuration
  + Demonstrate routing of traffic between VLANs
  + Document operation
* **Test 2: Frame Relay and EIGRP Configuration** 
  + Demonstrate functionality of primary Frame Relay link
  + Demonstrate MD5 authentication process
  + Demonstrate routing to remote resources
  + Document operation

# **Equipment**

| **Quantity required** | **Model** | **Additional options or software required** | **Substitute** | **Cisco IOS software version** |
| --- | --- | --- | --- | --- |
| 2 | 1841 router | none | Any router with two Ethernet or Fast Ethernet interfaces capable of running 802.1q protocol | 12.2 or later |
| 1 | Preconfigured router to simulate ISP; can be 1841 with two Fast Ethernet interfaces | none | Any router or multilayer switch that can support two separate Ethernet networks | any |
| 1 | Preconfigured router to simulate Frame Relay switch | Configured as a Frame Relay switch | Any Cisco router with two serial interfaces | 12.2 or later |
| 3 | 2960 Layer 2 switch | none | Any 2950 or 2960 model switch | 12.2 or later |
| 1 | Discovery Server | HTTP and FTP server software |  |  |
| 2 | Personal computer end devices | Fast Ethernet NIC | none | Windows, Mac, or Linux operating system |
| 2 | V.35 DTE cables | none | V.35 crossover cable | n/a |
| 2 | V.35 DCE cables | none | none | n/a |
| 5 | Cat 5 or above straight-through patch cables | none | none | n/a |
| 3 | Cat 5 or above crossover patch cables | none | none | n/a |
| 1 | Console cable | none | none | none |

# **Test 1 – Basic Connectivity and VLAN Configuration**

|  |
| --- |
| **Goals of Test**  Verify that the test topology is up and running and that VLANs are correctly configured between switches S1 and S2 and router BR2. A VTP domain is to be set up with S1 as the server and S2 as a client. S1 should also be the STP root switch. The Frame Relay links and EIGRP routing protocol are not included in this test (although they may be configured). |

|  |
| --- |
| **Data to Record**  BR2, S1, and S2 running configuration  VLAN configurations on switches S1 and S2 and router BR2  STP and VTP configurations on switches S1 and S2  Ping output between hosts H1 and H2, switches S1 and S2, and router BR2 |

# **Procedures**

1. Build the topology according to the Design and Topology diagram. Assign IP addresses to all devices according to the IP Address Plan, and activate interfaces.
2. Create a basic configuration on all Team-A and Stadium Network devices
3. Configure Team-A LAN devices S1, S2, and BR2 to support VLANs.
4. Console into one of the switches in the topology, and ping BR2. Record any anomalies.
5. Telnet from the switch to router BR2, and verify that you can start a session.
6. Verify that the BR2 routing table contains routes to each VLAN.
7. Ping from the hosts to their default gateways and between VLANs to each other.
8. Record the output of the **show running-config** and **show interfaces** commands for BR2, Edge3, and switches S1 and S2 in a text file, using a text editor such as Notepad. Record the output of the **show vlans** command for BR2 and switches S1 and S2.Save this file for later analysis.

# **Expected Results and Success Criteria**

* VLANs exist on switches S1 and S2.
* Hosts can ping successfully to hosts on other VLANs.
* Switches S1, S2, and router BR2 can ping each other and are accessible through Telnet.

# **Results and Conclusions**

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**Test 2 – Frame Relay and EIGRP Configuration**

|  |
| --- |
| **Goals of Test**  Verify that the Frame Relay link to the Stadium network is functional, the EIGRP routing protocol is properly configured with MD5 authentication, and the correct static routes are configured. |

|  |
| --- |
| **Data to Record**  BR2 and Edge3 running configuration with Frame Relay, EIGRP, and MD5 authentication  Frame Relay **show** command output  EIGRP MD5 authentication debug output  IP routing table information  Ping output between hosts H1, H2, routers BR2 and Edge3, and Discovery Server  Tracert output from H1 and H2 to Discovery Server |

# **Procedures**

1. Configure Frame Relay on the Team-A and Stadium Network routers.
2. Configure EIGRP with MD5 on Team-A and Stadium Network routers.
3. Record the output of the **debug eigrp packet** command on the Team-A router to verify MD5 authentication.
4. Record the router output of the **show running-config** and **show ip route** commands.
5. Record the router output for the Frame Relay circuit using the **show frame-relay map**, **show frame-relay pvc,** and **show frame-relay lmi** commands.
6. Record ping results from the hosts H1 and H2 to the Edge3 router and the Discovery Server.
7. Use **tracert** or **traceroute** to verify that packets are taking the primary Frame Relay link.

# **Expected Results and Success Criteria**

* EIGRP debug output shows that the Team-A and Stadium Network routers are authenticating with each other.
* IP routing table information for the Team-A and Stadium Network routers shows that they have learned EIGRP routes and the route from Team-A to the Stadium Network is via the primary Frame Relay link.
* Ping tests from hosts H1 and H2 to the Discovery Server are successful.
* Traceroute tests from H1 and H2 to the Discovery Server are successful and take the primary Frame Relay link.

# **Results and Conclusions**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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